Effect of chloride driven copper redox cycling on the kinetics of Fe(II) oxidation in aqueous solutions at pH 6.5-8.0

YINGYING SUN, A. NINH PHAM AND T. DAVID WAITE*

School of Civil and Environmental Engineering, The University of New South Wales, Sydney, NSW 2052, Australia (*Correspondence: d.waite@unsw.edu.au)

The kinetics of Fe(II) oxidation by nanomolar concentrations of Cu(II) under both oxygenated and deoxygenated conditions at circumneutral pH (6.5-8.0) and varying NaCl concentrations (0-0.7 M) have been investigated. In the absence of O_2, oxidation of Fe(II) by Cu(II) followed second-order kinetics with the rate of oxidation increasing with increasing pH and chloride concentration. In the presence of O_2, while the rate of Fe(II) oxidation by both O_2 and Cu(II) still increased rapidly with increasing pH, the effect of chloride was reversed with a faster overall removal of Fe(II) observed in the absence of chloride. Even though Fe(II) reacts slowly with Cu(II) in the absence of chloride, rapid re-formation of Cu(II) renders Cu(II) a more effective oxidant under this condition. Formation of Cu(I) and its concomitant transformation indicated that Cu(I) is a product in the oxidation of Fe(II) by Cu(II). A simple kinetic model has been developed which adequately describes the oxidation of Fe(II) by Cu(II) over a range of experimental conditions.